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ScienceDirect

Procedia - Social and Behavioral Sciences 102 (2013) 392 – 401

Procedia
Social and Behavioral Sciences

6th International Forum on Engineering Education (IFEE 2012)

Engineering Education and Sustainable Development: the Missing Link

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Abstract

Knowledge is vital for any society. The well being and robustness of any society is dependent on the acquired knowledge of its components. All of the divine religions attest to this universal tenet. Universities and institutes of higher learning are regarded as centers where knowledge is created, taught, and applied for the benefit of mankind. Knowledge is continuously being developed and updated so that it can enlighten and improve the lives of our global community. Universities are beacons of hope, peace, new ideas and ideals, and exemplary discipline to those who function and enrol in them. They are centers that educate and train future generations of engineers, scientists, technologists, economists, and politicians who will bear the brunt of leading and directing this world of ours into the future. The future is unknown; thus a need for well qualified, realistic, pragmatic, and above all, ethical and moral 'managers' who will make the right decisions, so that society's and indeed, mankind's aspirations, goals, and objectives will be achieved and realized. Literature and debate on sustainable development has concentrated mainly on physical and tangible issues and assets: population growth, resource depletion, environmental impact, climate change, poverty, and illiteracy. While the list is not exhaustive, many pundits have failed to realize that the most pressing ingredient and the most scarce resource facing the sustainability concept is not in the physical components of society's endowment, but rather, the ethical and moral values of 'managers' – individuals that are entrusted to plan, oversee, and implement a successful economic and social development program that will sustain mankind to live in peace, prosperity, and harmony with this universe. This paper examines this 'missing link' in our understanding and application of sustainable development concept. It is argued that universities need to proactively and aggressively 'infuse' ethical and moral teachings and values into their respective curricula. It is expected that this infusion will, in due course of time, produce engineers, scientists, and other decision makers who will have a more robust foundation and significance of the missing link, and will, therefore, voluntarily and enthusiastically operate in accordance with sustainable development objectives.

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Selection and/or peer-review under responsibility of Professor Dr Mohd. Zaidi Omar, Associate Professor Dr Ruhizan Mohammad Yasin, Dr Roszilah Hamid, Dr Norngainy Mohd. Tawil, Associate Professor Dr Wan Kamal Mujani, Associate Professor Dr Effandi Zakaria.
doi:10.1016/j.sbspro.2013.10.754

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Keywords: sustainable devleopment; university; engineering curriculum; society; ethics; moral values.

1. Introduction

Sustainable Development (herein referred to as SD) has been defined in many forms [1-11]. Literally, sustainability implies a continuous and a renewable ability to perform something. SD is therefore a type of development that is characterized by self perpetuating itself, it has an inherent generator or a dynamo that keeps it recharged and continuously keeps it 'going'. This type of development is also characterized by ability to provide the needs of the present generations without compromising the well being of future generations. It is inter-temporal in essence. The underlying thesis of SD is based on, and is concerned with inter-temporal economic, and human (social) development, and environment protection. The concept, as defined, is mostly theoretical, but awareness and inclusion of the underlying foundations of sustainable development our daily dealings and transactions are important to ensure that the concept is practically executed and not only a theoretical undertaking.

The current global environment can be described as a knowledge-based environment. Technology is becoming more and more embedded in the well being, development, and competitiveness of any society. Globalization has effectively rendered country boarders irrelevant in terms of business ventures, marketing, and trade between nations. Societal values, norms, and traditions that are inherent in any particular society or a country are literally at risk of being replaced or influenced by other apparently 'care-free', less 'traditional', more 'liberal', and seemingly more 'appealing alternatives' especially to the younger generation. Information technology and ease of information transfer and connectivity between peoples of different backgrounds, ethnicity, culture, and, religion have all resulted in a more dynamic and less predictable consequence in terms of global stability, preservation of national identity, and altruistic qualities that are becoming a characteristic of bygone generations. It is important to tie all of these developments and their holistic implication on inter-temporal well being of future generations.

The grand objective of any development is to satisfy the inter-temporal basic needs of society, promote economic and social development (on both micro- and macro- scale), and preserve a clean environment, or at least, minimize adverse environmental impact. Industrial development and its derivatives (economies of scale, mechanization, division of labor, increase resource use) have effectively mass produced goods, have reduced the per unit cost of production, and have also increased pollution. In order to satisfy the exponential increase in global population, coupled with the buying power in developed and developing countries, demand for both inputs and outputs have considerably increased. The lifetime of durable and consumer goods is limited; at the end of the useful life of a product, it needs to be disposed of (or recycled, if applicable). It is obvious that following this type of reasoning, there are constraints on resource availability, resource use, allocation of resources, and, social and environmental impacts that will result from this 'development'. Decision makers that include engineers, scientists, technologists, lawyers, economists, politicians, and all other experts in various technical and non-technical fields need to effectively pool their expertise and knowledge together and develop an optimal plan that would achieve the goals that are listed at the beginning of this paragraph. This is part of what sustainable development calls for.

Voluminous literature has indicated that sustainable development has three components: the social, economic, and environmental (*op cit*). The challenges that the planet earth faces cover all the three aspects. Thus, a proper prioritization of the problems is required in order to effectively address and solve the most pressing issues with the available financial and human resources. The extent, intensity, and degree of achievement (positive or negative) in each of these three components is basically dependent on a plan and

decisions that are made by humans. Mathematical or engineering tools may be used to assist decision maker to evaluate the different proposals and chose the best one that will achieve the required and stated goals. At the end of the deliberation, however, it is up to a human being to make a final decision on the best course of action regarding the prioritized proposals. Hence, the human input as a planner and a decision maker is probably one of the most important components of achieving SD. Questions that are relevant in this context include: what options that are proposed would maximize human development, minimize human suffering, make life pleasant and more enjoyable, promote peace and stability on this planet, encourage cooperation and sympathy among peoples, and inter -temporally preserve environmental and other resources? These are key issues that need to be objectively addressed by decision makers at all levels if sustainable development is to be practically achieved. Short of that, SD will be merely reduced to a debate topic that will be scavenged by academics, environmentalist, and other 'pundits' to politicize and revolve around an important and a noble concept that can greatly improve the health, wealth, and inter-temporal well being of this planet and its inhabitants.

This paper examines the human dimension of the SD concept, and specifically engineering education and SD. Engineers have the knowledge and expertise to technically analyze problems, and propose solutions for the accommodating needs of increasing number of people and improving their living conditions. Engineers are at the forefront of making decisions that will have long-term implications for the planet. Given the finite capacity of the earth, and its resources, it is recognized that engineers of the future must be trained to make decisions in such a way that our environment is preserved, social justice is promoted, and the needs of all people are provided through global economy. It is argued that, in addition to development and preservation of physical and environmental earth resources respectively, a 'forgotten' and an important necessary ingredient for SD is an ethical and a moral decision maker. The physical availability and constraints of resources must be linked with the ethics and moral components of a human being in order to actually and effectively promote, attain, and maintain SD.

2. SD and the Current Environment

This section summarizes the current global environment and its relationship with SD principles. SD is really about responsibility, caring, integrity, empathy, truth, moral and ethical values, and moral leadership that characterize a society and its components. All of these qualities are universally accepted as virtues that are an envy to any society. Real life indicators of how the global environment and global leadership is conducting its business are not encouraging. Commitment to truth is becoming a rare commodity. Cheating, cutting corners, falsifying records, economic, political, social scandals are rampant in this 'new world order'. Social responsibility, altruism, social responsiveness, and social obligation are qualities that may be declining globally. Materialism, consumerism, and indifference to 'others' are on the rise.

The UN Millennium Development Goals (MDG) [12] include a list of noble ambitions: eradicate hunger and poverty, education, gender equality, improve maternal health and reduce child mortality, disease reduction and control (AIDS, malaria, etc), environmental sustainability, and global partnership for development. Other equally important ambitions that are embedded in MDG include availability of and access to: clean water, information technology, and basic energy. A large amount of resources has been and is being expended on addressing these important issues. However, with the limited resources that are available to implement decisions, it is important to prioritize the issues and the problems that our globe is facing. Social injustice and massive human suffering worldwide has resulted in massive popular revolt around the globe, as evidenced by the Global Occupy Movement.

The finite resources that this planet possesses must be optimally and justifiably consumed. Signs of development (both human and economic) and optimal resource allocation and use are abundant; development in many countries of the world attests to this. On the other hand, we also deliberately or otherwise, destroy, destabilize, and pollute the planet, and then build, and reconstruct it. This approach is definitely not in

accordance with SD or its principles. Most of the destruction that we observe on a global scale is man-made, not natural, and contradicts with natural instinct of a human being. Large amounts of resources and investment are destined for development and production of the most potent military machine that will be most destructive and produce the highest number of casualties in people and property. Cover-ups in illegal and inhuman practices such as industrial pollution, corruption, bribery, and political destabilization of countries by capitalizing on its ethnic make-up of and promoting or inciting friction and animosity between citizens, control of a country's natural (and mineral) resource countries are, regrettably, some of the man-made destructive decisions that are employed worldwide. Most, if not all of these unfortunate, painful and uncivilized incidents are man-made, and are not indicative of any civilized, moral, ethical, and humane behaviour. Where is sustainability from all of this reality that is evident in our day-to-day dealings? Moral leadership and an overwhelming commitment to truth and human life dignity will not allow for such behaviour or decisions that lead to such consequences. It is therefore, evident, that there is a short-circuit somewhere in leadership and decisions that come from it. Decisions makers, at all levels of our society are the ones who steer this world to an unsustainable path.

In spite of numerous international meetings, conventions, committees and commissions to address and implement SD objectives, the general outcome on goal achievement is minimal and disappointing; and the world has failed to deliver on many of the promises that were made 20 years ago at the earth summit in Brazil [13-14]

Government interference in the free market in terms of regulation and endless and complicating array of regulatory instruments are enacted in order to ensure acceptable and humane terms of reference between producers/manufacturers/providers of goods and services and those who consume them. In spite of this rigorous and extensive government intervention, cheating, cutting corners, bribery, and consumer rip off are rampant. The question is what has gone wrong?

Worldwide, the intensity and extent of scandals in its general term is alarming. Major scandals that include business, ethical, moral, social, political, and others show an increasing trend. These scandals are committed by people and officials from all walks of life: politicians, engineers, medical doctors, sports trainers, coaches and so on. Top and well paid executives, middle managers, and those on the first level of the management hierarchy may all be involved in this socially unacceptable behaviour. The scandals that are reported are probably a small percent of what is actually being committed. Some examples of 'bad news' governance scandals, and issues from last decade: Enron (2001), Tyco (2002), WorldCom (2002), NYSE CEO (2003), Royal Dutch/Shell, Unilever, Rio Tinto (2003), Hollinger International (2003), Deutsche Bank (2003), Yukos (2004) [15].

The ills of a society are regularly being reported in local, national, and international media. These include unemployment, falling real buying power of money, foreclosures (US, Europe), young people not able to afford college, seniors being threatened that their social security and medicare will be taken away or reduced, and climate change and its implication on a global scale .Based on the proclamations and speeches of the Occupy Movement worldwide, it seems that society at large has finally decided not to be passive about expressing its views on the path that is traversed.

3. Sustainable Development, Ethical and Moral Behaviour

All of the Abrahamic religions teach us to live and to consume responsibly. All religions command us to live with civility, responsibility, altruism, care, and not to inflict wound or adverse impact to any living or non living thing. A person's life is sacred, so too are the lives and sanctity of other worldly creatures. Lying, cheating, bribery, exploitation of weak by strong and bearing false witness is universally prohibited in all worldly religions. These are 'utopian' qualities that are an envy to any civilized and caring society.

Education is at the heart of human development and this is obvious in the significance and attainment of education in all the religions and their respective teachings. The cross-fertilization of Christian Europe with the Islamic world shaped and developed the European Renaissance and Enlightenment. Religion has also,

unfortunately been employed to create intolerance and killings. Egoism and overconsumption are vices that are prohibited in all of the divine religions.

In spite of all these evident and commendable assets from religion and religious teachings, the world is moving farther and farther away from religion. Religion and religious teachings are marginalized in today's high tech and global environment. Secularism and the secular way of life is being continuously promoted and glamorized. Religion in general and Islam in particular, is frowned upon, and regarded as promoting, terrorism, backwardness and/or uncivilized behaviour.

There are ample signs and indications that especially in the western countries, religion is showing a slow but accelerating decline. In UK, for instance, half of the population do not belong to any religious grouping or affiliation. Between 1983 and 2009, British attitudes towards religion –Christianity in particular, shifted significantly: those who indicated no-religion rose from 31 per cent in 1983 to 51 percent in 2009; in the same time frame, those who identified themselves as Christians fell from 66 per cent to 43 per cent, and those who belonged to 'other' religions rose from 2 per cent to five per cent. The decline of religion also evident across Western Europe.

Even in those other countries where religion is apparently strong and on the increase, it is important to ask and to critically investigate whether those who associate themselves with a religion really believe and more importantly, practice what they are required to. Practical evidence suggests that is not the case. Sincerity, religious practice and practical adherence to a particular religious teachings are on the decline globally. What do these indicators and trends mean for society and policy in general? One obvious casualty of decline in religion and religious practice and values is continued and rapid increase in liberal attitudes towards a range of issues, as well as selfishness and indifference toward fellow human beings and the universal rule of law. Material and economic ends are justified regardless of means. Might is right. This is not accordance with SD foundation.

Traditionally, ethics, moral values and practice have been defined and explained by, and based on religion, tradition, and culture. The culture in many instances is aligned to religious teachings. There is no doubt that if we are all ethical in our dealings and practice, and obey morality principles, then all the components of a civil society, individuals, organizations, and society will be better off. The individual is the basic and a fundamental component of a society. A family is made up of individuals, who most likely share common values and norms. These values are generally related to, are shaped by, and transcend from religion, culture and traditions. A society or a community is a congregation of many individuals who generally share common values and beliefs, culture and norms. The point that is made here is that if an individual is ethical and morally competent, then the family, the community, and the society at large will portray those noble and sustainable attributes that will make this planet and its components sustainable. Organizations, their employees at different managerial levels, as well as their constituents will all exhibit the highest examples of moral and ethical responsibility and practice that is in line with their intrinsic personalities. Leaders in such organizations and those on top echelons of any enterprise will have considerable strength and courage to practice and demand ethics and moral behaviour from all of their employees.

Globalization and information technology have to a great extent, practically melanged and pooled different traditions, values, and norms of global societies into a global 'cocktail' baseline that may contradict with individual values and traditions of the component parts. This baseline mode of reference may be deficient in some aspects of the ethical component of religious teachings that are espoused in all the worldly great religions. Regrettably and unfortunately, due to decline in religion adherence in today's globalized world, people's dealings with each other and with the planet as a whole have been divorced from basic ethical and moral values. The extent and intensity of destruction in innocent lives and property on global scale is a testimony to this emerging and threatening behaviour.

4. Engineering: Program and Profession

Education in general, and engineering education and profession in particular, are witnessing and confronting a challenging crossroad. Globalization, 'new world order', global crises (e.g., global economic crisis starting in 2008 and continuing, EU crisis and continuing, Arab 'spring', the 99% Occupy movement have reshaped the environment in which we live. The world has shrunk a great deal due to information technology and globalization. This has greatly impacted- and will continue to- impact the socio-economic structure of countries, their competitiveness in the global arena, meeting environmental challenges and improving the welfare of their respective populations. Countless opportunities and challenges have resulted from these developments. The quality and components of education that a country delivers on its population has and will undoubtedly play a major role in prosperity and sustainability of nations. Competition is now a key concept in survival of any enterprise, where quality, durability, price, and 'green-ness' of production and product are of paramount importance. It is thus important to dynamic-ize the (engineering) education and programs so that it is in tune with and responds to the times and societal needs. This section first examines the current general engineering program and then identifies the missing link to adjust to the current reality and needs.

Solid preparation and good mastering in mathematics and science are key ingredients to any engineering curriculum. Technical courses in engineering programs include mathematics (calculus, analytical, numerical, and linear algebra), science courses (physics, chemistry, and/or biology), computer and programming. Other courses may include statistics, management, economics, cultural studies and humanities.

Being a good engineer is dependent on understanding and having a good grip on technical courses, especially mathematics and other sciences. In addition, an engineer needs to be able to appreciate society's needs, priorities society's problems, and, optimally and inter-temporally propose solutions, given the resources. Therefore, a more holistic engineering program is required; a program that is comprised of a good mix of engineering, scientific, technological knowledge, plus managerial, innovation, economic, communication, and more importantly ethical and moral knowledge and skills.

Engineers are problem solvers. They are required and expected to make decisions that will affect their organization, themselves, and their society in terms of their well being, economically or otherwise. They are required to act professionally, ethically, and maintain social responsibility in their profession and in their decisions. Engineering projects such as airport construction, petroleum and natural gas, mining, chemical and petrochemical plants, and waste facilities all have apparent benefits and costs to society. Communities that live in close proximity to these projects may likely be affected (positively or negatively) by the proposed engineering projects. In any type of a project or a venture there are benefits and costs that can be monetary or otherwise. Environmental impacts of the project needs to be properly assessed before a go-ahead is granted to a contracting company. This is an EIA (Environmental Impact Assessment) that is supposed to provide justification for the project, and provide a detailed assessment of potential benefits and adverse effects of the proposal. It is important that engineers believe in and operate on the independence and objectivity of their work, and not to be viewed at by the public as being mouthpiece for the proponents of the projects for monetary or material gain.

Engineers make conclusion based on a scientific approach: data, analysis, interpretation, and conclusion. An objective and an unbiased approach in all stages must be preserved. Deliberate and outright misrepresentation or omission of data, falsifying records, and deliberate distortions are contrary to the required and expected ethical and moral stance of engineers.

5. The missing Link

The current and rapidly evolving workplace and environment in which young engineers will be operating is characterized by the following challenges, threats, and opportunities:

- A global platform where inputs are obtained, marketed, and products are manufactured, and exported.
- Competition for survival (business, self, flora, fauna, etc)
- Environmental 'degradation' due to industrial and economic development.
- Promotion and awareness of SD and practice.
- Knowledge availability and expertise is easily and readily available.
- Communication technology has rendered distance between sender and receiver almost irrelevant.
- Personal and human-behavior qualities and attributes such as trust, truth, ethical and moral behavior are declining. Regulation and 'watchdog' are in place to enforce these human and humane virtues.
- Inequality in living standard and provision of the basic necessities of life among human populace.
- Massive and deliberate destruction of human lives and property due to wars, political and ethnic conflicts, control of resources, etc.
- A more inter-dependent world in terms of planet's survival.

The list is by no means exhaustive; nevertheless it provides an idea of the global situation that young engineers will be operating in. There is thus a need to produce engineers who are appreciative of, and innovative in, providing solutions to key issues that society, mankind, and the planet confront. The current engineering curriculum does not fully incorporate these current realities in their respective program of study. The modus operandi that existed in the 20th century faced other 'problems' and priorities that are different from those that we face today in the 21st century. Thus, there is a need to adjust the structure and components of engineering education [16-19].

There is an urgent and an overwhelming need for engineering curriculum to effectively include, address, and prioritize the ethical and moral concepts in its program. This is the fundamental missing link for engineering education. For sustainability to be properly and practically practised, its benefits to be comprehensively achieved, and to result in inter-temporal benefits for the globe and its inhabitants, it is absolutely crucial and necessary that we raise a generation that live by and believe in strong ethical and moral foundation. If every component of our society starting with leaders, decision makers, engineers, scientists, lawyers, bankers, politicians, and all other professionals and non-professionals alike lives on and is guided by strong and unwavering ethical and moral principles, then a major portion of SD goals will be achieved. The question is 'How can we train engineers to fit into this type of a model. A combination of approaches is proposed in this section. These proposals all have one thing in common: to educate and to train engineers to be ethical, considerate, and caring; i.e., to promote, build, and practically live and work on a real altruistic quality.

First, it is obvious that educating young engineers on the basic ingredients of SD and sustainable living should be a key prerequisite in any engineering program. Three approaches are envisaged in this context:

- Stand-alone courses that provide historical evolution of sustainability concept and justification for SD.
- Embed SD concepts in specialized engineering courses.
- Case studies, practical real-life examples, EIA, that are relevant to SD.
- SD-specialized seminars where professional and subject-related speakers from industry are invited.

The current engineering curriculum does not effectively incorporate SD concepts and its significance to society. It is thus important to expose, initiate awareness, and educate engineering students of the basics and fundamental issues in sustainability of mankind and its development. Topics that might be relevant in this context include industrial and economic development, environmental impacts, globalization, population growth and its general impact on resource use, availability, and environment, the social-cultural-political-ethical-and moral-impacts of development, global crises and problems that confront mankind and the wider environment , and their relevant impacts on society and future generations. These are the contemporary issues that confront us and our environment.

Secondly, it is important to restructure and re-develop the way an engineer thinks, decides, and deals with members of his society. Ethics and moral values need to be reminded and re-instilled in an engineer's mind. Transparency and commitment to truth should be key qualities that form the personality of an engineer. Courses, seminars, debates and actual scenario-based case studies on ethics and moral behaviour are proposed. Exposure to, and education in actual case studies are necessary in order to train and equip future engineers with the reality and dilemmas of modern life that they might face when they actually practice their profession.

Third, engineering curriculum needs to incorporate contemporary issues in lifestyle such as consumerism, and life-cycle concept in its program. A product's footprint is dependent on many stages in its lifecycle: from inception stage-pilot scale-production-use-and, finally disposal. A product may be (or thought of) as green, but it might have adverse environmental (or other) impact at one stage of its lifecycle.

Fourth, an important addition to engineering curriculum is a course devoted to "Energy: sources, availability, use, efficiency, conservation, and environmental impacts". This addition is absolutely necessary for any engineering discipline. Our civilization, our development, and our well-being are all dependent on energy. Greenhouse gases and their impacts on sustainability of the planet are thought to be caused by use of fossil fuel as energy source.

Engineers are entrusted by society to use knowledge, innovation, and imagination to make life easier and more enjoyable for the present and future generations. Products and decisions that engineers make today will, to a great extent, shape future lifestyles and robustness of the society and its inherent environment. It is thus important to have decision makers that are knowledgeable, morally and ethically competent, and socially responsible. These are important qualities that are at the forefront of requirements for any organization that wants to be responsible and sustainable. Short term and personal benefits should not be an ingredient for any decision making that is sustainable.

Decision makers are expected to have a mixture of attributes and skills: good managerial skills (technical, human, and conceptual), uphold the highest ethical and moral standards, and, provide effective leadership and direction to subordinates peers, teammates) for the benefit of society. It is important to train and educate engineers of the decision-making process and steps that is holistic in nature. This approach needs to take into consideration not only the economic and business aspect of a proposal, but more importantly, the social and inter-generational components. Industry-wide practical case studies can assist in this objective.

Fifth, the role of communication skills in engineering education cannot be over-emphasized. It is obvious that due to the rapidly developing technologies for inter-connecting the world, shifting global patterns of manufacturing and trade, free and generally unrestricted movement and mobility of professional worldwide, the need to effectively understand and communicate between peoples of different background, custom, traditions, and religion, is becoming more and more became important. Well equipped and well-versed engineers with excellent and multi-lingual communication skills, and knowledge and appreciation of different customs, norms, values, and traditions are critical in attaining the competitiveness of engineering programs.

Other important attributes that are a must-have for a competitive and a first-class engineer are: vision, innovation, creativity, entrepreneurship, sincerity, truth, and love of work without being overly supervised. The question is how can these concepts and qualities be instilled to an engineering curriculum? Management course for engineering may be a good place to start. Real-life engineering problems and seminar presentation from industry that deal with, and impacts of engineering projects on human development, economic progress, and on improving the general welfare of a society may provide an incentive or impetus for vision and creative thinking.

Heavy dosage on ethical and moral-based courses should be an important addition to engineering curriculum. Engineers need to be aware that the public expects them to operate in a clear, ethical, moral and in a transparent manner that is based on scientific findings and acquired data. The concept of conflict of interest, its meaning, and its implication on an engineer and engineering as a profession, his/her organization, and society at large is an important concept that should be exposed to and instilled in young engineers. Content in this courses need to be specific and relevant to the engineering profession in order to maximize benefit and application to a practicing

engineer. The distinction between public interest, self interest, organizational interests, society's interest, and future generations' interest should be clearly and explicitly dealt with in relevant courses. This is an important area where young engineers need to be exposed to and rehearsed on. Conflict of interest is and will continue to be a sticky problem for decision makers who are not fully aware of the distinction between these paradigms. Engineering code of ethics require engineers to consciously place the public interest above all other interests. Welfare of the public, health, and safety of the community should take preference over self or organizational interest. It is important to incorporate practical examples and incidents that will practically teach students of the reality that is practiced by working engineers.

Ethics is the basic foundation for attaining SD. As such it is important to instil ethics in engineering (and all other disciplines of specialization. The significance and role of ethics in engineering education cannot be overemphasized. Currently engineering programs offer ethics and professional practice course as an entity or a separate course by itself. In addition, ethics can and should be incorporated/integrated, where possible, in other technical engineering courses. Proper approach of ethics dosage is required in the curriculum. Case studies from real life, competent, well versed and experience-laden professors should be tasked as special instructors so that students will be motivated, interested, and creative in the dynamic ethic training. Proper, intensive, and practical-oriented training and practice of ethical decision-making approach is imperative.

6. Conclusion

SD is a multifaceted, multi-disciplinary, dynamic, and an inter-temporal concept. It encompasses social, ethical, and political behavior. It requires professional, knowledgeable, enthusiastic, and well mannered. implementers. There is no dearth of knowledge or information about sustainability, sustainable development, and a blue print of how to achieve it. Research in this area and proposed course of action is abundant. While all three facets of SD are important and should complement one another for the sake of sustainability of this planet, it is obvious, from literature survey that the environmental component has received relatively more attention, with the social and human component the least. Globalization and rapid development in information technology have resulted in new global challenges and opportunities. Engineers are problem solvers; the engineering curriculum has to adjust accordingly to address and confront the new set of realities. Innovation and creativity are crucial to the global competitive arena. Decisions that engineers make must be based on high ethical and moral grounds that call for and prioritize social and organizational goals. It is important for engineers to appreciate the diversity of the work environment; parochial views are not suitable for the new environment. Communication skills are becoming more important in a globalized world, and this needs to be reflected in engineering curriculum.

There is an urgent need to have qualified, well-rounded and well-informed engineers who will voluntarily, effectively, and wholeheartedly implement SD principles in its entirety. A revolution in ethics is needed to improve the chance of success for SD. It will basically replace the egoism and greed of decision makers that have resulted in many of the woos of the present global reality. Decision makers that include engineers, the community, and society needs to redefine, address, and prioritize the real issue facing this generation and future generations.

The key to any enterprise that wants to succeed in a highly competitive 'environment' is to have the right people in the organization. 'Right' is universally defined, with all the attributes that are an envy to any society. Ethics and moral concepts are embodied in 'right', and this should be the benchmark of a right behavior for any decision maker. Religion and religious teachings and abiding to them are 'right'. Globalization and secularism has practically replaced religion and traditional values, ethics, moral, customs, and norms with egoism, and material-oriented mentality. The existence of injustice and inequality in providing the basic necessities of life, increasing trend of scandals, and destruction and instability on a global scale all reflect the unhealthy and regrettable condition of this planet and its inhabitants. It is high time to reinstate the glorious and proven remedies and social saviors to engineering curriculum. This will undoubtedly improve the probability that SD

with all of its noble, glorious and commendable objectives become a reality, rather than restrict the concept to academic debate and conference topic.

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